Implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020

Status as at 6 Nov 2020

A report for the National Electricity Market

Important notice

PURPOSE

AEMO publishes this report to inform industry about AEMO's implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020 (Mandatory PFR Rule).

This publication has been prepared by AEMO using information available at 6 November 2020. This information will be updated and superseded by future implementation reports until full implementation.

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1. Summary

This report provides information on the implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020[1] (Mandatory PFR Rule). It will be updated periodically as implementation proceeds, at intervals of approximately two to three weeks.

The Mandatory PFR Rule affects *Scheduled Generators* and *Semi-Scheduled Generators* (Affected Generators), who are initially required to undertake a self-assessment of the ability of their *generating systems* (Affected GS) to provide *primary frequency response* (PFR) in accordance with the *primary frequency response parameters* (PFRP) specified in the interim *Primary Frequency Response Requirements* (IPFRR).

Implementation of the Mandatory PFR Rule will be carried out in three tranches, as specified in the IPFRR. The results of the self-assessments (Results) for Tranche 1[2] Affected Generators were due on 28 August 2020, with implementation of setting changes for generation in Tranche 1 commencing from around 30 September 2020.

AEMO has also started receiving Results from Affected Generators with Affected GSs in Tranches 2 and 3. Some have provided draft Results and discussed issues associated with meeting the PFRP. Results for Affected GSs in Tranche 2 are due by 19 November 2020, and for Tranche 3 by 17 February 2021.

Table 1 shows the number of Results, applications for variation and exemption received as at the date of this report.

Table 1 Results and Applications received

Number of Affected GS	Results	Applications for Variation	Applications for Exemption
Tranche 1	76	18	8
Tranche 2	19	2	3
Tranche 3	8	0	2

2. Self-Assessments

AEMO has received Results in respect of 103 Affected GSs across all three Tranches. Several Affected Generators have forwarded preliminary or draft Results for informal feedback.

AEMO has completed its review for 84 of those, covering around 33,600 MW of installed capacity. A register of Affected GSs with agreed PFR Settings is listed in Table 4.

[1] Available at https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response.

[2] Tranche 1 Affected GS are those with a *Registered Capacity* above 200 MW. Tranche 2 Affected GS are between 80 and 200 MW. Tranche 3 are below 80 MW/. All Registered Capacities are the level of the individual DUID.

3. Applications for Variation

Table 2 details the number of applications for variation received in respect of Affected GSs, those granted and those still under consideration as at the date of this report.

The majority of variations granted in Tranche 1 were in relation to response time.

Table 2 Variations

Number of Affected GS	Applications for Variation	Variations Granted	Variations not Granted	Variations being Assessed
Tranche 1	17	15		2
Tranche 2	2	2		
Tranche 3	0			

4. Applications for Exemption

Table 3 details the number of applications for exemption received in respect of Affected GSs, those granted and those still under consideration as at the date of this report.

Table 3 Exemptions

Number of Affected GS	Applications for Exemption	Exemptions Granted	Exemptions not Granted	Exemptions being Assessed
Tranche 1	8		8	
Tranche 2	5			5
Tranche 3	2			2

5. Implementation of PFR Settings

5.1 Tranche 1 Implementation

Implementation of PFR Settings for a substantial fraction of generation in Tranche 1 has been achieved. Information on actual and expected timing of setting changes in shown in Table 4.

AEMO is continuing to work to achieve implementation of PFR Settings across the largest possible proportion of Tranche 1 Affected GSs prior to Summer 2020-21.

Some Affected Generators have indicated a preference to make staged changes to frequency response deadbands, in which case, more than one implementation date is listed in Table 4. Other Affected Generators have elected to alter settings in one step, and in these cases, a single implementation date is listed.

In some cases, expected implementation dates have changed from those reported previously. This has occurred for a number of reasons, including:

- Affected GS forced outages
- Delays in Affected GS returning from planned outages.
- Delays in provision of key information or advice from OEMs.
- Affected Generator resourcing constraints.
- Problems encountered when altering settings.

In all cases, the earliest reasonably achievable date, subject to these constraints, has been determined, or re-determined (as applicable) after consultation with the relevant Affected Generator.

5.2 Implementation for Tranche 2 and 3

As outlined in the IPFRR, Tranche 2 and Tranche 3 Affected Generators are required to complete their self-assessments by 19 November 2020, and 17 February 2021, respectively.

Power system reliability and security concerns suggest that requiring control system setting changes across a large number of Affected GSs in the middle of Summer 2020/21 might not be prudent as this is, typically, the most challenging period of the year for power system operations.

Noting these competing demands, it is currently proposed that implementation of setting changes would be targeted for completion by the following dates:

- Tranche 2 (DUIDs 80 MW – 200 MW) – By 30 March 2021
- Tranche 3 (DUIDs below 80 MW) – By 30 June 2021

5.3 Flexibility in Implementation Dates

Some flexibility in implementation dates exists, particularly if an Affected Generator wishes to complete implementation of setting changes earlier than previously agreed. Affected Generators currently undertaking commissioning activities may wish to undertake the necessary work while specialist staff remain available and onsite.

Provided they consult with AEMO beforehand, Affected Generators may commence making setting changes earlier, or in an incremental manner, to achieve their PFR Settings by the specified implementation date.

Power system conditions, such as major network outages, could also require alterations to implementation dates, though this has not been necessary to date.

5.4 Generation providing PFR prior to Mandatory PFR Rule

Previous surveys of generator active power controls, and more recent engagement with Affected Generators indicate that no large Affected GSs were providing PFR that fully met the PFRP prior to the Mandatory PFR Rule.

AEMO is aware of a small number of, typically, smaller or low capacity factor Affected GSs that are operating in a way that could meet the PFRP (at least partially). These are identified in Table 4 following confirmation from the Affected Generator.

6. Register of Affected GS

Table 4 details, for each Affected GS, the planned or actual dates for completion of implementation of the PFR Settings notified by AEMO in accordance with the IPFRR, and whether AEMO has granted an exemption or variation from the PFRP. Where a variation has been granted, the table also indicates which PFRP has been varied.

A single implementation date under the 'Stage 1' column indicates that full implementation of the PFR Settings is to be, or has been, achieved by that date. The 'Stage 2' column will only be populated where the deadband is to be, or has been, tightened in two stages.

Tranche 2 (in blue font) and Tranche 3 (in green font) generation is being added to this table as AEMO completes their assessments.

At the time of writing, Affected GS's with an installed capacity of approximately 19,200 MW have either partially or fully implemented PFR Setting changes, or were already providing PFR that meets the PFRP.

This represents approximately 33% of the approximately 58,000 MW of NEM installed capacity that will ultimately be captured by the Mandatory PFR rule.

Table 4 Register of Affected GS

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Ararat WF	ARWF1	241	End of week commencing 9 Nov 20	End of week commencing 23 Nov 20			
Barker Inlet PS	BARKIPS1	211	Pre-existing			Yes	Response time[4]
Bayswater PS	BW01	660	29 Sep 20	14 Oct 20			

[3] This column will be populated only when deadband adjustments will be made in two stages.

[4] AEMO has granted a variation in respect of response time, where 12 sec is required to achieve a 5% change in output. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Bayswater PS	BW02	660	16 Oct 20				
Bayswater PS	BW03	660	3 Nov 20				
Bayswater PS	BW04	660	29 Sep 20	14 Oct 20			
Bogong / Mackay PS	MCKAY1	300	22 Oct 20				
Callide B PS	CALL_B_1	350	8 Nov 20	16 Nov 20			
Callide B PS	CALL_B_2	350	30 Sep 20	28 Oct 20			
Callide C PS	CPP_3	420	9 Nov 20	12 Nov 20		Yes	Response time
Callide C PS	CPP_4	420	Late Dec 20[5]			Yes	Response time
Coopers Gap WF	COOPGWF1	452	30 Nov 20	14 Dec 20			
Crudine Ridge WF	CRURWF1	138	Upon completion of commissioning.				
Darling Downs PS	DDPS1	644	15 Jun 20				
Darlington Point SF	DARLSF1	324	Upon reaching 200 MW HP				
Eraring PS	ER01	720	27 Oct 20			Yes	Response time
Eraring PS	ER02	720	16 Oct 20			Yes	Response time
Eraring PS	ER03	720	13 Oct 20			Yes	Response time
Eraring PS	ER04	720	20 Oct 20			Yes	Response time
Gangarri SF[6]	TBC[7]	120	Upon completion of commissioning				
Gladstone PS	GSTONE1	280					
Gladstone PS	GSTONE2	280					
Gladstone PS	GSTONE3	280					
Gladstone PS	GSTONE4	280					
Gladstone PS	GSTONE5	280					

[5] Implementation of PFR settings on this unit requires repair of key auxiliary plant, with an exact date yet to be determined.

[6] Affected Generator not registered yet; still undergoing commissioning.

[7] DUID not yet assigned.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Gladstone PS	GSTONE6	280					
Glenrowan West SF	GLRWNSF1	132	Upon completion of commissioning.				
Gordon PS	GORDON	432	Unit 1 – 11 Dec 20 Unit 2 – 28 Sep 20 Unit 3 – 29 Sep 20				
Hallett PS	AGLHAL	217	27 Oct 20[8]				
Jemalong SF	JEMALNG1	50	Upon completion of commissioning.				
Kiamal SF	KIAMSF1	239	Upon reaching 200 MW HP				
Kogan Creek PS	KPP_1	744	23 Nov 20	26 Nov 20			
Liddell PS	LD01	500	25 Nov 20				
Liddell PS	LD02	500	25 Nov 20				
Liddell PS	LD03	500	25 Nov 20				
Liddell PS	LD04	500	25 Nov 20				
Limondale 1 SF	LIMOSF11	275	Upon reaching 200 MW HP				
Lincoln Gap WF	LGAPWF1	212	End of week commencing 16 Nov 20				
Loy Yang A PS	LYA1	560	14 Oct 20				
Loy Yang A PS	LYA2	530	14 Oct 20	End of week commencing 9 Nov 20			
Loy Yang A PS	LYA3	560	End of week commencing 9 Nov 20				
Loy Yang A PS	LYA4	560	15 Oct 20				
Loy Yang B PS	LOYYB1	500	12 Dec 20	17 Dec 20			
Loy Yang B PS	LOYYB2	500	30 Sep 20	28 Oct 20			
Macarthur WF	MACARTH1	420	16 Nov 20				
Millmerran PS	MPP_1	426	1 Oct 20	28 Oct 20		Yes	Response time

[8] Applicable to one generating unit, remainder previously complied with the PFRP.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Millmerran PS	MPP_2	426	After RTS in mid Nov 2020			Yes	Response time
Morgan Whyalla Pump PV1	MWPS1PV1	6	Upon completion of commissioning in Feb 2021				
Morgan Whyalla Pump PV2	MWPS2PV1	6	Upon completion of commissioning in Feb 2021				
Morgan Whyalla Pump PV3	MWPS3PV1	8	Upon completion of commissioning in Oct 2020				
Morgan Whyalla Pump PV4	MWPS4PV1	6	Upon completion of commissioning in Feb 2021				
Mortlake PS	MORTLK11	283	30 Sep 20				
Mortlake PS	MORTLK12	283	After RTS in early Nov 20.				
Mt Piper PS	MP1	700	After RTS in late Dec 20.				
Mt Piper PS	MP2	700	29 Sep 20	28 Oct 20			
Murra Warra WF	MUWAWF1	231	End of week commencing 16 Nov 20				
Murray PS	MURRAY	1500	31 March 21[9]				
Newport PS	NPS	500	28 Sep 20	19 Oct 20			
Pelican Point PS	PPCCGT	478	30 Sep 20				
Poatina PS	POAT220	200	Pre-existing			Yes	Deadband, Response Time[10]
Poatina PS	POAT110	100	Pre-existing			Yes	Deadband, Response Time[11]

[9] One *generating unit* (out of 14) will have PFR Settings implemented after RTS in Oct 2021.

[10] The variation to the deadband at ±150 mHz is for 6 months only. The variations were granted due to the inherent capability and design of the Affected GS. This information is included with the consent of the Affected Generator.

[11] The variation to the deadband at ±150 mHz is for 6 months only. The variations were granted due to the inherent capability and design of the Affected GS. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Sapphire WF	SAPHWF1	270	End of week commencing 16 Nov 20				
Shoalhaven PS	SHGEN	240	Bendeela Unit 1 – 31 October 2022 Bendeela Unit 2 - 31 August 2021 Kangaroo Valley Unit 3 -30 November 2023 Kangaroo Valley Unit 4 -31 August 2021				
Smithfield Energy Facility	SITHE01	161	Pre-existing				
Stanwell PS	STAN-1	365	27 Oct 20				
Stanwell PS	STAN-2	365	27 Oct 20				
Stanwell PS	STAN-3	365	27 Oct 20				
Stanwell PS	STAN-4	365	29 Oct 20				
Swanbank E GT	SWAN_E	385	16 Nov 20			Yes	Response Time
Tallawarra PS	TALWA1	440	Upon RTS from outage in late Mar 2021				
Tarong North PS	TNPS1	443	21 Oct 20			Yes	Droop, Response Time[12]
Tarong PS	TARONG#1	350	27 Oct 20				
Tarong PS	TARONG#2	350	3 Nov 20				
Tarong PS	TARONG#3	350	27 Oct 20				
Tarong PS	TARONG#4	350	27 Oct 20				
Tumut 3 PS	TUMUT3	1500	30 Nov 20				
Tumut 1 & 2 PS	UPPTUMUT	616	30 Nov 20				
Vales Point B PS	VP5	660	30 Sep 20			Yes	Deadband[13]

[12] The droop characteristics applied to the unit do not meet the requirement for a droop of 5% or less. This variation is granted for a period of 12 months only. An ongoing variation on response time has been granted. This information is included with the consent of the Affected Generator.

[13] AEMO has granted a variation to the deadband at ±100 mHz based on the unique condition of the Affected GS for a period of 12 months. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2[3]			
Vales Point B PS	VP6	660	30 Sep 20			Yes	Deadband[14]
Wivenhoe PS	W/HOE#1	285	26 Oct 20			Yes	Response Time
Wivenhoe PS	W/HOE#2	285	26 Oct 20			Yes	Response Time
Yallourn W PS	YWPS1	360	28 Oct 20				
Yallourn W PS	YWPS2	360	29 Sep 20	28 Oct 20			
Yallourn W PS	YWPS3	380	29 Sep 20	28 Oct 20			
Yallourn W PS	YWPS4	380	29 Sep 20	28 Oct 20			

7. Impact on Frequency Performance

AEMO provides detailed reporting on power system frequency performance in its Frequency and Time Error Monitoring reports[15] published quarterly. The most recent report was published in August 2020, with the next update due in mid November 2020.

This report focuses on a sub-set of the matters raised in the quarterly report and provides some information focusing on relatively recent frequency performance to help capture impacts on power system frequency that are (at least in part) associated with the implementation of the Mandatory PFR Rule.

0 shows the monthly frequency distribution for the last six months (01 Apr 2020 to 4 Nov 2020). Figure 2 shows the day-by-day frequency distribution from around the time Affected Generators began implementation of their PFR Settings at the end of September 2020.

These figures show improvement in the closeness of the distribution of frequency around 50 Hz, particularly from the 2nd half of October 2020, where many generators moved to final PFR settings. This trend is expected to continue as additional Affected GSs implement PFR Settings during the following weeks and months.

Figure 3 shows a comparison of the daily frequency distribution, at monthly intervals from Jun 2020. Following the commencement of implementation of PFR setting changes from the end of September 2020, and ongoing through October 2020, the improvement in the control of NEM frequency to near 50 Hz is clear.

[14] AEMO has granted a variation to the deadband at ±100 mHz based on the unique condition of the Affected GS for a period of 12 months. This information is included with the consent of the Affected Generator.

[15] Available at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-and-time-deviation-monitoring.

Figure 1 Monthly frequency distribution (six-month rolling, 01 Apr 2020 to 04 Nov 2020)

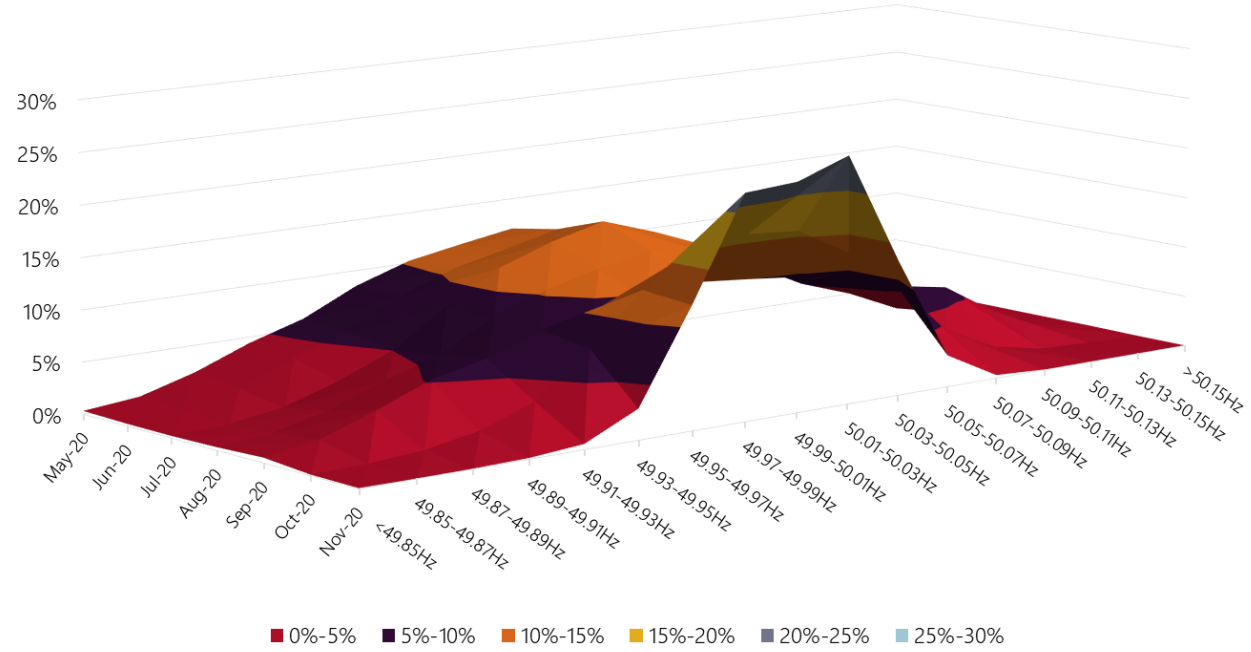


Figure 2 Daily frequency distribution (data from 01 Sep 2020 to 04 Nov 2020)

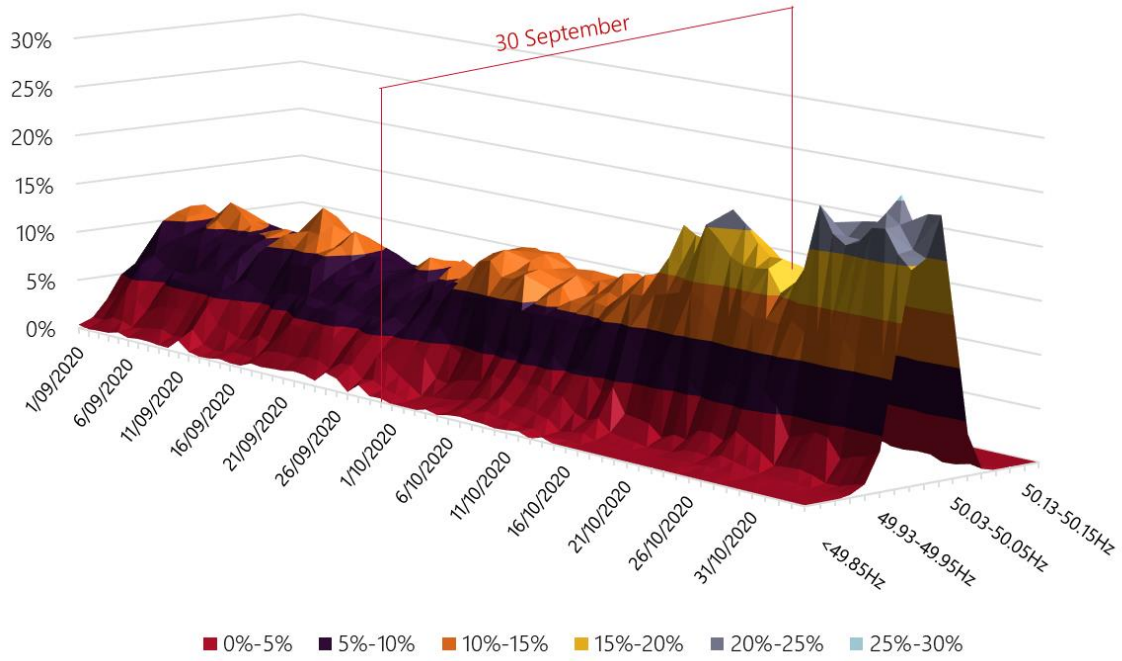
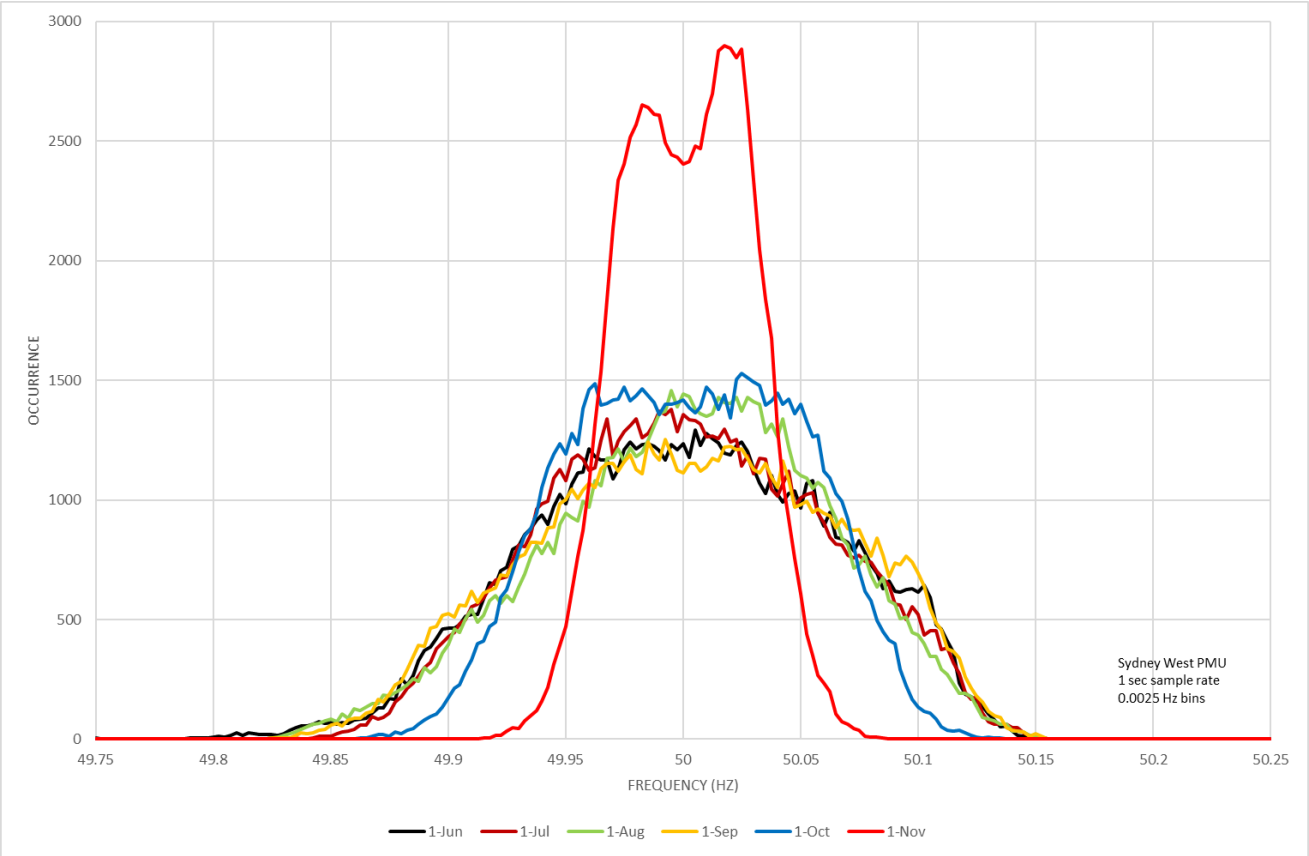


Figure 3 Daily frequency distribution at monthly intervals – June to Nov 2020



The total number of departures from the normal operating frequency band (NOFB) and the number of times frequency crossed the nominal 50 Hz is shown on a monthly basis in Figure 4 and on a day-by-day basis in Figure 5.

These figures show a significant reduction in the number of excursions outside the NOFB following the commencement of implementation of PFR setting changes from the end of September 2020, and ongoing through October 2020.

Figure 4 Monthly frequency crossings – under 49.85 Hz, across 50 Hz, beyond 50.15 Hz

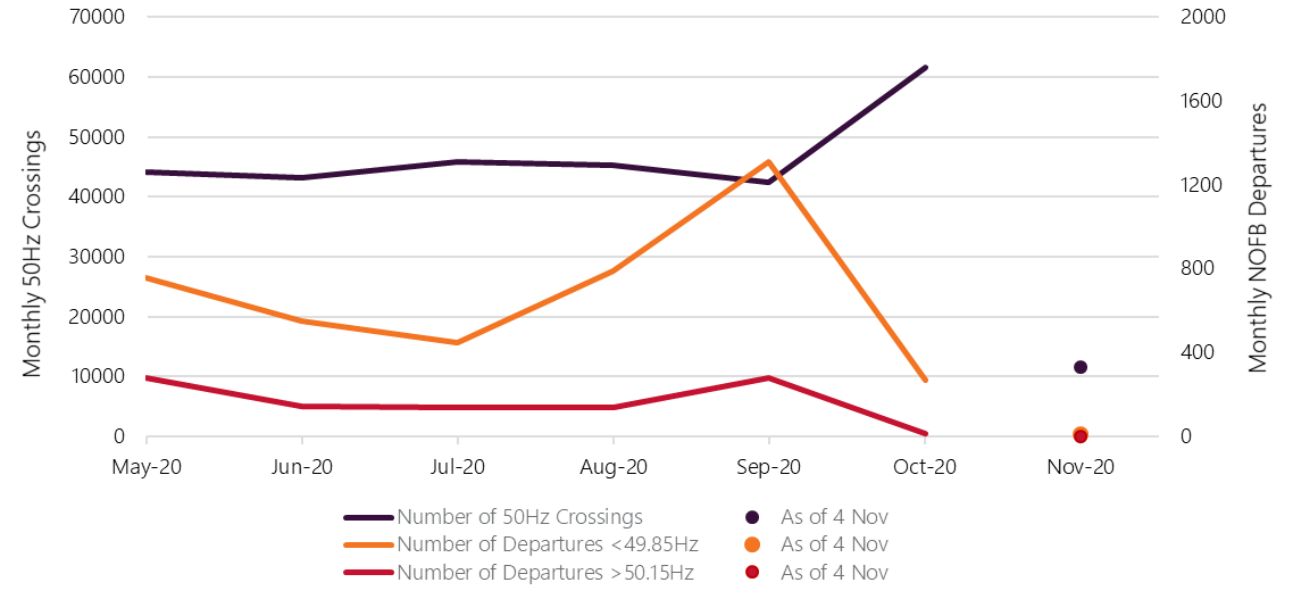
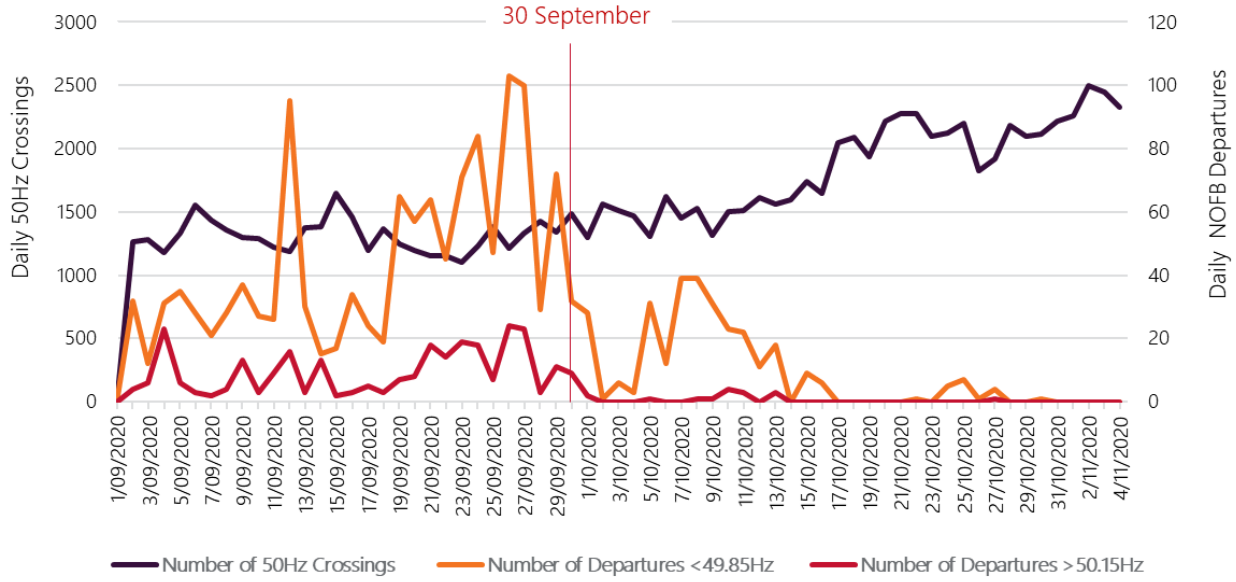


Figure 5 Daily frequency crossings – under 49.85 Hz, across 50 Hz, beyond 50.15 Hz



Glossary

This document uses many terms that have meanings defined in the National Electricity Rules (NER). The NER meanings are adopted unless otherwise specified.

Term	Definition
Affected Generator	As defined in the IPFRR.
Affected GS	As defined in the IPFRR.
CCGT	Combined Cycle Gas Turbine.
DUID	Dispatchable unit identification.
GT	Gas Turbine
HP	Hold Point. A point during commissioning of new *plant* determined by reference to *generation* output.
IPFRR	Interim Primary Frequency Response Requirements.
Mandatory PFR Rule	National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020.
NOFB	*normal operating frequency band*.
PFR	*primary frequency response*.
PFR Settings	The settings to achieve the provision of PFR in accordance with the IPFRR, as notified to an Affected Generator by AEMO.
PFRP	*primary frequency response parameters*.
PS	Power Station.
PV	Photovoltaic
Results	As defined in the IPFRR.
RTS	Return to service following an *outage*.
SF	Solar Farm.
Tranche 1	Affected GS with a *nameplate rating* of >200 MW.
Tranche 2	Affected GS with a *nameplate rating* between 80 MW and 200 MW.
Tranche 3	Affected GS with a *nameplate rating* of <80 MW.
WF	Wind Farm.